Odyssey of the Eyes
Intermediate Level

Purpose

To familiarize students with the concept of modeling as it is related to remote sensing and to the process of digitizing images.

Overview

Students will use the symbolic map created in the beginning activity to produce a digitized image. As they perform the activity, they will begin to see why ground verification of satellite data is necessary in order for scientists to create accurate models of the Earth's systems.

Student Outcomes

Science Content

Science and Technology

Scientists rely on technology to enhance the gathering and manipulation of data.

Science as Inquiry

Communications involves coding and decoding.

Tables, graphs and symbols are alternative ways of representing data.

Use numerical data in describing and comparing objects and events.

Geography

Primary

Maps and satellite-produced images

Middle

Characteristics, functions, and applications of maps, globes, satellite images

Enrichment

Objects in a remotely sensed image are interpreted and digitized into a code based upon the object's reflectance of bands of light.

The image codes are relayed through a satellite dish to a computer for storage or enhancement.

Image display is accomplished by conversion of stored data to a user-defined color-coded image.

Scientific Inquiry Abilities

Observe, digitize and interpret an image.

Level

Middle

Time

Two to three class periods

Materials and Tools

Graph paper

Pencils

Maps and models from *Odyssey of the Eyes Beginning Level*

Plastic overlay with *Odyssey of the Eyes Grid*

Colored pencils

Odyssey of the Eyes Digitized Data Sheet

Preparation

Assemble the materials.

Demonstrate the process of digitizing to the class before you have students work with partners.

Prerequisites

Students should know how satellites receive information and relay it to a computer.

Odyssey of the Eyes Beginning Level is necessary for the completion of this activity.

Note: This activity presents concepts similar to those in steps 8, 9, and 10 of the *Relative and Absolute Directions Learning Activity* in the *GPS Investigation*.

Welcome

Introduction

Protocols

Learning Activities

Appendix

Background

The sun emits energy in the form of light. This light energy reaches the earth. The light is composed of many bands of light, including visible light. Visible light is made up of red, orange, yellow, green, blue, indigo, and violet. Each object on earth reflects visible light differently. Some objects reflect all visible light (objects that appear white to us), others absorb all visible light (objects that appear black to us), and some reflect different amounts for each band of visible light. Satellites record the amount of light reflected from objects on the ground. They store this information as data or code. These codes or data are visualized on a computer and called satellite images.

What To Do and How To Do It

Part 1: How Digitized Images Are Made

Students will learn how satellites and computers communicate with each other. One student will serve as the satellite and the other will represent the computer. Using a black and white picture, the student "satellite" will scan a picture, translating it into a digitized code. The student "computer" will translate the numeric code, reproducing the image.

1. Students work in pairs. One serves as the satellite and the other represents the computer. The satellite places the plastic overlay with the *Odyssey of the Eyes Grid* over the black and white picture of the *Odyssey of the Eyes Satellite*. The satellite scans the picture, one box at a time, starting at the left-hand corner of the picture. The satellite calls out a number code for each box on the grid to his or her computer (partner). The computer writes the number code on their grid.

2. The satellite will interpret each square according to the following guidelines:
   - The satellite indicates the beginning and end of each scan line with a "0."
   - **If a box is white:** the satellite interprets the message as a "1."
   - **If a box is gray:** the satellite interprets the message as a "2."
   - **If a box is black:** the satellite interprets the message as a "3."
   - **If a box is not all black, all gray or all white:** the satellite must make a decision as to the best possible choice, "1", "2" or "3." The "satellite" should make his decision based on whether the square is mostly black, gray, or white.

3. Using a pencil, the student representing the computer translates the digital code onto the graph paper, creating a satellite image. They begin or end a line when they read a "0," leave a box blank when they read a "1," and shade in the square lightly if they read a "2" or shade in the square black, if they read a "3."

Example:

If the boxes in the first row are white, white, black, mostly black, and gray and the second row is white, gray, black, mostly white, and gray; the "satellite" would translates this to [01133200123120]. The computer writes down this code and then colors in the grid of the first row with white, white, black, black, gray and the second row with white, gray, black, white, gray.

Note: For additional practice, use student generated color pictures and different size grids.

Part 2: Making a Digitized Image Using Data From a Map Model

1. Supply each group with a plastic grid overlay (made from the Odyssey of the Eyes Grid). Have the students place this grid over the symbolic map from *Odyssey of the Eyes Beginning Level*.

2. Ask students to create a color and number code (key or legend) for the land cover items on their map. Assign each landform on the symbolic map a color and a number. Record this on the *Odyssey of the Eyes Digitized Data Sheet*.

3. Ask students to create the digitized code for their map:
   - Begin and end each scan line with a "0."
   - Scan each line of the symbolic map, "coding" each square with a number determined by the *Odyssey of the Eyes Digitized Data Sheet*.

- Record the numbers on the data chart.
- Review the guidelines in *Part One* of this activity for further assistance.

4. Finally, using the digitized code, ask students to select the matching colors and reproduce the map as a digitized image on a piece of graph paper.

Discussion and Assessment

1. Look at your symbolic map.
   a. What is different about the digitized map or image?
   b. What is the same?
   c. Do you think that the image and model both represent the same amount of each land cover type or landform?
2. Look at your original model.
   a. What is different about the digitized map or image?
   b. What is the same?
   c. Do you think that the image and model both represent the same amount of each land cover types or landform?
   d. Look at the symbolic map. Look for differences and similarities between the symbolic map and original model. Can you name two of each?
3. Compare and contrast maps produced by other groups:
   a. How do you know the maps are accurate?
   b. What happens to land cover types that are a small size when you draw a symbolic map or digitize an image?
   c. What happens to land cover types that have irregular shapes?
   d. How do these changes affect what type and amount of land cover you see?
4. What function does the satellite perform when mapping?
5. What function does the computer perform when mapping?
6. Why are maps from one group of students different than maps from another group?
7. Do the colors chosen to represent each type of land cover have to reflect what you see on the ground?
8. How would digitizing your model be different if the model were illuminated under blue light?

Note: Ground verification is what you are doing in some of the *Land Cover/Biology Protocols*. In the *Land Cover Sample Site Protocol*, students verify what is actually on the ground compared to what is interpreted by a satellite image or a model.

Extension

The Landsat satellite collects the data for your GLOBE Study Site. Label the parts of the Landsat satellite and describe what each part does. For diagrams and information about Landsat, see the Land Cover/Biology GLOBE website at
http://www.globe.unh.edu
Also see the following Landsat websites
Landsat NASA website at
http://geo.arc.nasa.gov/sge/landsat/landsat.html
Landsat 8: http://www.nasa.gov/mission_pages/landsat/main/#.VME4fC6Bd2E
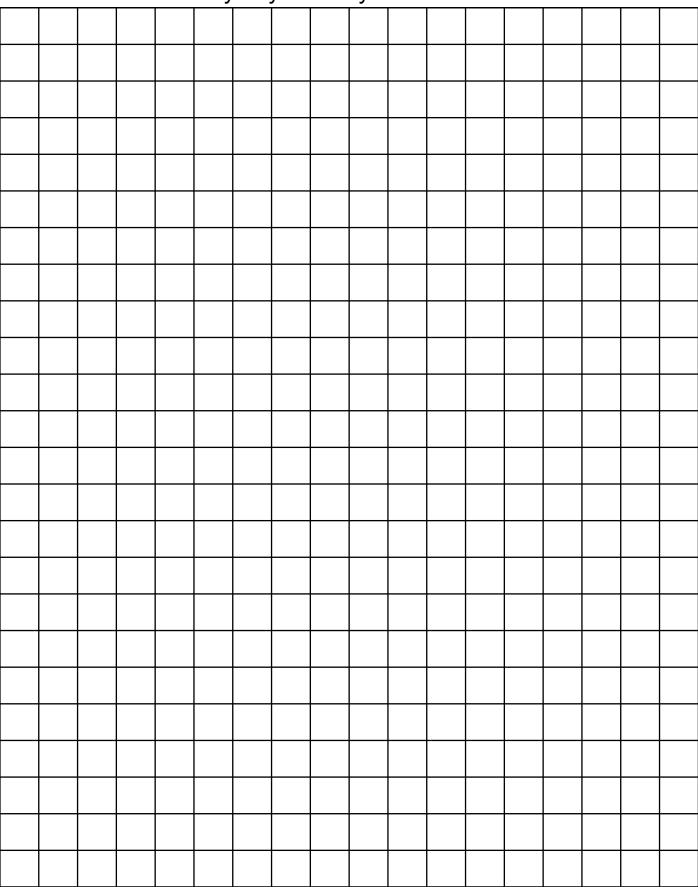Landsat Data Continuity Mission website:
http://science.nasa.gov/missions/ldcm/

Acknowledgment
Satellite art by Sherri Wormstead

Odyssey of the Eyes Large Grid

Odyssey of the Eyes Small Grid

Odyssey of the Eyes
Digitized Data Sheet

Name: _____ Date: _____

Land Cover Type	Symbol	Numbers	Digitizing Code
Example: Road	≡≡≡	1	Black
Example: Tree	▲	2	Green

Digitized Code

Use a 0 to indicate the beginning and ending of each scan line.

For the large-sized grid squares, use the following lines as an example of how to set-up your paper.

0 ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ 0

0 ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ 0

For the small-sized grid squares, use the following lines as an example of how to set-up your paper.

0 ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ 0

0 ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ 0